

# Influence of RMB Internationalization on International Crude Oil Price Fluctuation

Xiaowen Guo<sup>1, a</sup>

<sup>1</sup>Graduate School of Management, Clark University, Worcester, MA, 01610, the United States

<sup>a</sup>XiaowGuo@clarku.edu

**Abstract:** In recent years, China has been gradually improving its international status. As far as monetary policy is concerned, China has been gradually promoting the internationalization of the RMB, aiming to reduce its dependence on the international financial market dominated by the US dollar and reduce the impact of the Federal Reserve's political measures on the domestic economy. Under the influence of global economic and financial market factors such as COVID-19, the international financial system dominated by the US dollar is unstable and dangerous, and the international financial system has become more volatile. In contrast, the implementation of this measure will have an impact on some international financial transactions, such as stock market price fluctuations, commodity prices and foreign exchange transactions. For a long time, the oil price has been dominated by the US dollar due to the linkage between the US dollar and oil, and has increased with the appreciation of the US dollar. However, the process of people's internationalization affected the oil price by changing this traditional logic and impacted the global status of the US dollar, thus reducing the oil price by triggering the decline of the US dollar. This paper would like to focus on elaborating the influence of RMB internationalization on international crude oil price fluctuation.

**Keywords:** RMB internationalization, Oil price, International financial market.

## 1. Introduction

In recent years, the European Union, Russia, China, and other large countries in the world have joined the ranks of de-Dollarization, which means that the dominant position of the US dollar in the international monetary system is in jeopardy. Under the epidemic crisis, the fragility of the US dollar led international financial system has become increasingly prominent, which makes more countries worry about that excessive reliance on the US dollar will lead to a more serious global financial crisis, and the trend of de-Dollarization is obvious. Against this background, China has been attempting to reduce its economic and financial system's dependence on the US dollar and create a financial market dominated by the renminbi. At the same time, after the COVID-19 epidemic, the international crude oil price fluctuated significantly, and China, as a major energy importer and consumer, has been increasingly dependent on the international crude oil market, which meant that the international crude oil market have had an increasingly important impact on the financial market in recent years. Under such influence, as an important measure to consolidate and improve China's financial market, the impact of RMB internationalization on international crude oil price fluctuations is particularly important. Therefore, this paper will focus on analyzing the impact of RMB internationalization on international crude oil price fluctuations through empirical research.

## 2. Literature Review

The research literature on currency internationalization and international crude oil price is very abundant, and the research related to this paper mainly includes the following categories.

The first type of literature is related research on the interfering factors international crude oil price fluctuations. There are many literatures on this topic, mainly empirical studies on the influencing factors of international crude oil

prices and regular pattern of price fluctuation, and discussion or suggestion of corresponding strategies. The main purpose of this paper is to study the impact of RMB internationalization on international crude oil price fluctuations, so it is necessary to explore the literature demonstration to establish this relationship. Gao Li and Huang Lina established SVAR model and empirically analyzed the impact of crude oil supply and demand, crude oil futures, stock index and US dollar exchange rate on international crude oil price fluctuations through impulse response function. The results show that, since 2002, the three financial factors of crude oil futures, stock index and US dollar exchange rate have a great impact on the fluctuation of international crude oil price, and the fluctuation of crude oil price is more intense[1]. This paper argues that RMB internationalization will affect the exchange rate of US dollar, and the US dollar exchange rate is an important factor affecting the fluctuation of international crude oil prices. Therefore, RMB internationalization will affect oil prices. With the promotion of the internationalization of RMB, the fluctuation of international crude oil price is bound to be affected, which is the main content of this paper. Tian Tianjun also analyzed the fluctuations of international crude oil prices. He emphasized the impact of financial factors on them and stressed the need to seize the opportunities brought about by the "the Belt and Road" strategy, actively carry out bulk commodity transactions with countries with the reserves and output of energy commodities such as oil and natural gas along the belt and road leading the world and improve the international influence of "RMB oil"[2]. According to the thinking of the above article, as one of the financial factors, the change of the international financial market is also one of the factors affecting the fluctuation of the international crude oil price. Then, with the continuous enhancement of the influence of RMB internationalization on the international financial market, the influence of RMB internationalization on the fluctuation of the international crude oil price will also

be strengthened. Therefore, it is more meaningful to study this topic.

The second type of literature is related research on RMB internationalization. With the advancement of RMB internationalization, more and more scholars attempt to study the impact of RMB internationalization. Through empirical analysis, Zhao Hui proved that RMB internationalization has a positive impact on GDP and the impact effect is sustainable, which can promote economic growth[3]. Ma Degong, Luo Yuke, and Zhang Yang used VAR model to empirically analyze the impact of RMB internationalization on China's financial risks[4]. In addition, the international influence of RMB internationalization is also increasing. Zhang Shizheng pointed out that the progress of RMB internationalization in the post epidemic era is in sharp contrast to the worsening of the US economy, which will have a great impact on the US dollar dominated international monetary system[5].

The above literatures mainly research the impact of RMB internationalization and the factors affecting the fluctuation of international crude oil price, but few literatures link these two points. Based on the fact that the internationalization of RMB is steadily advancing, this paper empirically explores the effect and mechanism of RMB internationalization in suppressing the fluctuation of international crude oil prices by quantifying the degree of RMB internationalization.

### 3. Model Setting and Variable Description

#### 3.1. Model setting

Initially, in order to intuitively verify the impact of RMB internationalization on international crude oil prices, we build the following econometric model:

$$oil\ price_t = \beta_0 + \beta_1 RII_t + \beta_j control_t + \epsilon_t \quad (1)$$

According to the above equation,  $t$  denotes the time,  $oil\ price_t$  denotes the international crude oil price,  $RII_t$  denotes the degree of RMB internationalization,  $control_t$  denotes the control variables, including the global economic growth rate, the proportion of each country's currency issue in GDP, and the debt to GDP ratio of each country.  $\epsilon_t$  represents a residual item. It is worth noting that since RMB internationalization is a time-series data, controlling the time effect will produce multicollinearity and its estimation coefficient cannot be obtained. Therefore, we did not control the time fixed effect in the estimation process. Simultaneously, for purpose of slowing down the impact of the lack of time fixed effect on the estimation results, this paper introduces macroeconomic variables such as GDP growth rate, exchange rate appreciation and depreciation rate and financial development level. This work is concerned about the RMB internationalization coefficient  $\beta_1$ ,  $\beta_1 > 0$  indicates that the

improvement of RMB internationalization level will aggravate the fluctuation of international crude oil price; otherwise, it indicates that RMB internationalization suppresses the fluctuation of international crude oil price.

In addition, in order to verify the channel through which RMB internationalization affects the fluctuation of international crude oil price, on the basis of benchmark regression, we refer to the research of Baron and Kenny [6], Wen Zhonglin and ye Baojuan [7] to build the following measurement model:

$$m_t = b_0 + b_1 RII_t + b_j control_t + \epsilon_t \quad (2)$$

$$oil\ price_t = c_0 + c_1 RII_t + c_2 m_t + c_j control_t + \epsilon_t \quad (3)$$

Among them,  $m_t$  is the intermediary variable. According to the previous research assumptions, it includes the other factors affecting the international crude oil price fluctuation, the meanings and measurement methods of other variables are consistent with the benchmark regression. This paper pays attention to the sign and significance of  $b_1$ ,  $c_1$ , and  $c_2$ . When  $b_1$ ,  $c_1$ , and  $c_2$  are both significant, if the sign of  $c_1$  is consistent with that of  $b_1$  and  $c_2$ , the mediation effect is positive, and vice versa.

#### 3.2. Variable description

Measurement of RMB internationalization. Currency internationalization means that a country's currency assumes the functions of transaction medium, accounting unit and value storage in the international financial market. Existing literature shows that there are mainly two methods to measure the degree of Currency Internationalization: first, the degree to which a country's currency bears the function of a single international currency, such as the currency's share of global foreign exchange transactions[8], international bonds and bills[9], and the central bank's share of foreign exchange reserves[10], can reflect the degree to which a country's currency bears a certain function of the international currency, while it is impossible to comprehensively measure the internationalization of a country's currency; Secondly, select multiple indicators of a country's currency performing the three major functions of international currency, and obtain a comprehensive currency internationalization index by weighted averaging these indicators. This method solves the limitation of a single indicator, and thus can comprehensively measure the internationalization degree of a country's currency. Based on this, in order to measure the degree of internationalization of RMB, this paper selects the secondary indicators of RMB performing the international monetary function. The specific indicator system is described in Table 1.

**Table 1.** RMB internationalization measurement index system

Primary Index	Secondary Index	Variable	Data Sources
Medium of Exchange	RMB share of global foreign exchange transactions	FETCR	BIS
	RMB share of international trade settlement	ITSCR	SWIFT
	RMB share of global direct investment	FDICR	IMF
Unit of Account	RMB share of international bonds and bills	IBNCR	BIS
Store of Value	RMB share of the central bank's foreign exchange reserves	RCR	IMF
	RMB share of global external credit	GFCCR	BIS

It is worth illustrating that the currency share of global foreign exchange transactions is published by BIS every three years. This paper uses interpolation to supplement the vacancy data.

In terms of weight setting, since each secondary indicator reflects the degree to which a country's currency performs the function of a single currency, and its importance to a country's currency internationalization is different, when it is impossible to make an accurate judgment on its weight, the subjective weight setting will affect the accuracy and reliability of the currency internationalization index, while the principal component analysis method converts multiple groups of highly related variables into a group of unrelated variables through dimensionality reduction. In addition, the final index is calculated by giving these variables weights. This method can solve the problem of subjective weight setting well. Therefore, this paper uses the principal component analysis method to give weights to each secondary index and calculate the comprehensive RMB internationalization index.

Specifically, it is assumed that the indicator system matrix  $X_{n \times T}$  is composed of N secondary indicators reflecting the

degree of RMB internationalization with a time interval of T,  $R_{n \times n}$  is the covariance matrix of the index system. Then note that the  $i$ th eigenvalue of the covariance matrix is  $\lambda_i (i = 1, 2, \dots, n)$ , the  $i$ th eigenvector is  $a_{n \times 1}^i$ , whereby the  $i$ th principal component can be expressed as  $PC_i = Xa_i$ , and  $\lambda_i = Var(PC_i)$ . According to the contribution of each principal component to the degree of RMB internationalization, a weighted average RMB internationalization index is constructed.

$$RII = \frac{\sum_{i=1}^n \lambda_i PC_i}{\sum_{i=1}^n \lambda_i} = \frac{\sum_{i=1}^n \sum_{j=1}^n \lambda_i a_j^i x_j}{\sum_{i=1}^n \lambda_i} = \sum_{j=1}^n w_j x_j \quad (4)$$

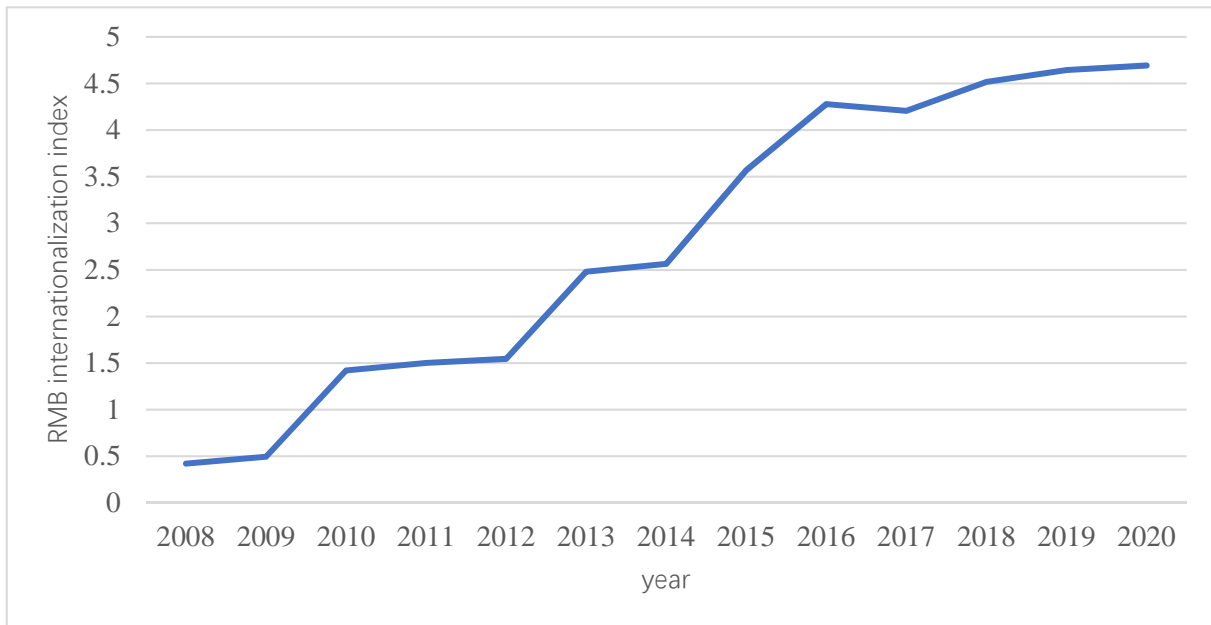
Where  $x_j (j = 1, \dots, n)$  is the  $j$ th column of matrix X, and the final weight  $w_j$  of  $j$ th secondary index can be expressed as:

$$w_j = \frac{\sum_{i=1}^n \lambda_i a_j^i}{\sum_{i=1}^n \lambda_i}$$

Table 2 reports the final weights of the secondary indicators used to measure the degree of RMB internationalization.

**Table 2.** Final weight of each sub index of RMB internationalization

Index	FETCR	ITSCR	FDICR	IBNCR	RCR	GFCCR
Weight	0.8606	0.0252	0.0047	0.0022	0.1060	0.0013



**Figure 1.** RMB internationalization index (RII)

From the overall data, the RMB internationalization index has been maintaining a relatively stable rise. As can be seen from Figure 1, from 2012 to 2016, the growth rate of RMB internationalization index was significantly accelerated, and the process of RMB internationalization was also continuously promoted. This is because during this period, China continuously improved the RMB internationalization infrastructure (authorized RMB overseas clearing banks and built the RMB cross-border payment system CIPS), strengthen monetary cooperation with other economies in the world (sign bilateral currency swap agreements) and achieve a higher level of openness (put forward the "the Belt and

Road" initiative), which can promote the internationalization of RMB. Between 2016 and 2017, there was a drop in the RMB internationalization index, which was affected by the "8.11" foreign exchange reform and the continuous depreciation pressure on the RMB. After 2018, the process of RMB internationalization has entered a relatively stable stage, and the RMB internationalization index is relatively stable, which means that China's promotion of RMB internationalization has entered a stable and prudent stage.

#### 4. Empirical Research

From Table3 shows that shows the benchmark regression

of RMB internationalization to crude oil price.

**Table 3.** Benchmark regression results

Variable	<i>oil price</i>		
	(1)	(2)	(3)
RII	-66.188*** (14.088)	-97.542*** (22.477)	-94.824*** (19.124)
HP_GDP_1	0.098 (0.079)	0.109 (0.079)	-0.031 (0.104)
M2	-3.843*** (0.543)	-4.509*** (0.765)	-4.461*** (0.477)
percentfin	833.513*** (244.300)	1227.364*** (498.023)	34.265 (349.624)
urban	5.457** (2.271)	-25.730 (27.527)	-23.414* (11.476)
constant	-346.470* (160.252)	-345.470* (160.255)	-441.455* (155.255)
Observation	13	13	13
R <sup>2</sup>	0.8734	0.8860	0.8958

Note: the values in parentheses are t values of estimation coefficients; \*, \*\*, \*\*\* respectively represent the significance levels of the estimated coefficients at 10%, 5% and 1%; In order to improve the accuracy of the estimation results, this paper adopts the enterprise level clustering robust standard error.

The above analysis shows that the internationalization of RMB has indeed brought about a decline in the price of the US dollar. Specifically, the internationalization index of RMB has increased by 1 unit and the oil price has decreased by 66 units. And this trend is significant in the range of 1%. This phenomenon shows that the oil price is significantly affected by the internationalization of RMB. The most typical example

is that China has signed oil trade agreements with Iran and Russia, which can be calculated in RMB. This means that the demand for oil denominated in dollars is reduced, and China, as a major energy consumer in the world, can control the world market. The internationalization of RMB will also impact the status of the US dollar, thus affecting the oil price linked to it.

As the internationalization of RMB broke the international monetary system dominated by the US dollar, the value of the US dollar fell. The price of oil linked to it will also be affected. Therefore, this paper takes the exchange rate of RMB to USD as the intermediate variable for analysis.

**Table 4.** Intermediary effect test

Variable	<i>oil price</i>	<i>e</i>	<i>oil price</i>
	(1)	(2)	(3)
RII		39.052* (19.745)	-47.808** (16.788)
<i>e</i>	-0.880*** (0.164)		-0.548*** (0.251)
HP_GDP_1	0.160 (0.094)	-0.453* (0.228)	0.165*** (0.055)
M2	-3.645** (1.369)	1.971*** (0.658)	-3.598*** (0.689)
percentfin	-1444.952*** (415.099)	-4598.529*** (1184.582)	-377.410 (497.053)
urban	-5.990** (1.741)	79.066** (26.896)	2.319* (2.890)
constant	1338.896*** (217.032)	-2746.715 (2579.880)	435.983 (395.705)
Observation	13	13	13
R <sup>2</sup>	0.8423	0.9185	0.9272

The data in the above table shows that after the RMB exchange rate against the US dollar and RMB internationalization are included in the model at the same time, the significance of RMB internationalization decreases significantly, so the intermediary effect is established.

## 5. Conclusion

Based on the measurement index of RMB

internationalization and the data of international crude oil from 2008 to 2020, this paper empirically explores the impact of RMB internationalization, a financial opening strategy, on the volatility of international crude oil prices by constructing a RMB internationalization index. According to the research, the promotion of RMB internationalization can significantly suppress the fluctuation of international crude oil price, that is, with the increase of RMB internationalization index, the fluctuation range of international crude oil price is

significantly reduced. As a major energy consumer, China's unilateral oil trade agreement will lead to a reduction in oil demand.

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